AN INTERESTING HABIT OF A WAX MOTH PARASITE.*

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INTRODUCTION.

During the fall of 1916, while rearing the bee moth, *Galleria mellonella* in the insectary for experimental purposes, a Pteromalid parasite *Dibrachys clisiocampæ* Fitch † was observed to be very common about the breeding cages. Further investigation disclosed the fact that these parasites were emerging from the cocoons of the bee moth. They were so abundant that very few of the larvæ of the host were able to pupate and come to maturity. This is interesting inasmuch as previous records of the parasite‡ give the host as the forest tent caterpillar, *Malacosoma disstria*.

During March these same parasites were emerging in such numbers from nucleus hives stored in the laboratory of the Bee Division that the windows of the room were literally covered with the small black insects.

Insofar as can be ascertained from the literature at hand, this parasite has never been recorded as attacking the bee moth, nor has its complete life history been described. This being the case and considering the possible value of this parasite in checking the ravages of the bee moth in stored combs, it was deemed advisable to keep the insect under observation during the winter and to determine as fully as possible its life history and habits.

LIFE HISTORY.

The host is attacked after spinning the cocoon, usually while still in the larval stage, but occasionally the pupa, while still soft and white, may be attacked. The female parasites walk rapidly over the cocoons feeling the surface with their antennæ. When a suitable place is found the caudal end of the

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† For the identification, I am indebted to Mr. A. J. Girault, formerly of the National Museum, Washington, D. C.

‡ Fitch—2d Report on Noxious, Beneficial and other Insects of the State of New York, page 432.

body is drawn forward until the abdomen is in a vertical position. The ovipositor is then inserted into the cocoon after which the abdomen again assumes its normal position and the ovipositor sheath slips into its place in the groove on the ventral side leaving only the ovipositor proper in a vertical position. At the same time the ventral segments are extended downward and forward, forming a triangular piece below the abdomen from the vertex of which the ovipositor extends. In removing the ovipositor this operation is reversed.

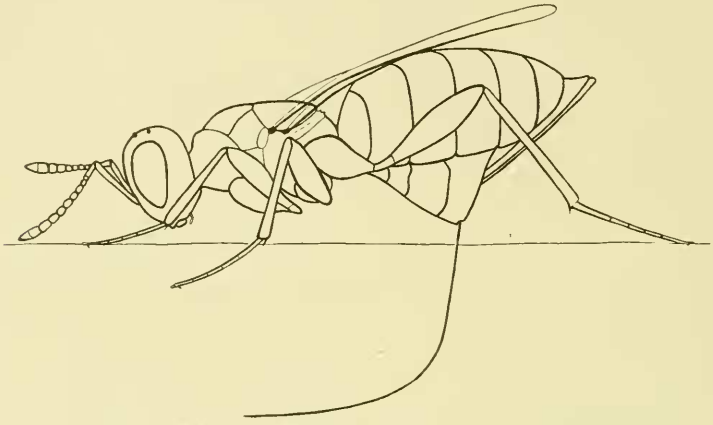

FIG. 1. Female *Dibrachys clisiocampæ* Fitch in position of oviposition.

As soon as the ovipositor is thrust into the cocoon the larva within becomes excited and moves about in an effort to get out of the way. The parasite thrusts its ovipositor into the larva, but does not deposit any eggs. It may stab it several times in different places before removing the ovipositor from the cocoon but no eggs are deposited until the larva within the cocoon is quiescent. This operation is repeated over and over again by the parasite as she walks from cocoon to cocoon, always stabbing the active larva with her ovipositor but never ovipositing in it. In from 6 to 24 hours the larvæ thus stabbed become sluggish and finally die.

When the parasite inserts her ovipositor and the larva remains quiet, she deposits her eggs on the surface of the body, usually in wrinkles in the skin. Usually two or three eggs are deposited in a place but often they are placed singly. The ovipositor can be bent in any direction and the egg after being forced almost entirely out, can be held by the tip and placed in

the proper position, and then released. The eggs are not fastened, but lie loosely in the folds of the skin of the host.

The eggs hatch in from 3 to 7 days and the young parasites immediately fasten themselves to the body of the host and begin to feed. The length of the larval stage was found to be rather variable, lasting from two to four weeks or even longer. Without exception, the moth larva was attacked by bacteria and reduced, before the parasite larvæ completed their growth, to a putrescent semi-liquid state, held together only by the skin of the host.

FIG. 2. Adults of *Dibrachys clisiocampæ* Fitch.

The pupal stage required from 14 to 25 days for its completion. Thus the life cycle from egg to adult varied from 31 to 59 days. The longest period occurred during mid winter when the temperature in the insectary often fell as low as 60° at night.

The adults feed readily upon sweetened water and under natural conditions, honey or nectar probably makes up a large part of their diet. The females were observed to puncture dead larvæ with the ovipositor and carefully draw up parts of the body tissue to the surface of the cocoon and then feed upon it.

HOST KILLED BEFORE OVIPOSITION OF PARASITE.

The one point in this life history which seems to be of unusual interest and perhaps practical importance is the fact that the parasite stings the host before depositing eggs upon it and oviposits only on dead or inactive larvæ.

The question naturally arose as to whether the larvæ were killed by the parasite or died from other causes.

Larvæ which had just died were examined by C. W. Howard of this Division, who was unable to find any indication that the caterpillars were killed by disease. After the larvæ had been dead one or two days, small brown spots appeared on the skin presumably at the points pierced by the ovipositor. These spots rapidly increased in size.

Larvæ, after being stung, but while still alive and active, were injected with a 1% solution of trypan blue and after about an hour were opened and the stain washed out. On examination, the skin and tissues immediately surrounding each puncture made by the ovipositor were found to be stained blue. Larvæ which had never been stung when injected in a similar manner, showed no such stained areas. It was thus possible to determine the number of times a larva had been stung by the parasite. The number of punctures in a single larva ranged from 6 to 38. There seems, therefore, to be no doubt that the parasite actually stings the larva.

In order to prove that this stinging kills the larvæ of the wax moth, forty healthy larvæ were placed in a glass jar containing no parasites. They spun their cocoons and at the end of three days were all perfectly normal. Then twenty of these were removed from their cocoons and placed in another similar jar where they again spun cocoons. Thirty parasites were then introduced into the first jar where the larvæ had been undisturbed, since spinning their cocoons. These parasites were observed to move actively about and sting the larvæ. In less than a week every larva in this jar was dead. The larvæ in the second jar were all alive and eventually eighteen out of the twenty reached maturity. This experiment was repeated three times with similar results in each case. This experiment showed that the larvæ were undoubtedly killed by the sting of the parasite, but whether death was the result of mechanical injury or of a poison injected by the parasite was the subject of further investigation.

A series of healthy larvæ were selected and each was pierced deeply with a minuten pin from one to twenty-five times. In spite of the fact that all stabbed in this way lost considerable blood and many were weak after the operation, every one recovered. Since the minuten pin was longer and thicker than the ovipositor of the parasite, this experiment indicates that the larvæ were not killed by mechanical injury, but that some poisonous material must be injected to cause their death.

Packard* refers to Bordas as authority for the statement that poison glands connected with the ovipositor may be safely said to be of general occurrence in the Hymenoptera. Dissection shows the presence of an organ which may be a poison gland but, as yet, this point has not been definitely determined.

Although apparently not mentioned in literature, this habit of killing the host before oviposition may be common to many of the ectoparasites of the superfamily Chalcidoidea. In support of this supposition it may be stated that the author has observed that the larvæ of the white pine weevil, *Pissodes strobi*, Peck, are always found to be dead when larvæ of the Chalcidid parasite *Eurytoma pissodis* Gir., are found upon them. The oviposition of this species has not as yet been observed. Marcovitch,† while working with parasites of the strawberry weevil, *Anthonomus signatus* Say, never found the eggs of certain Chalcidoid parasites on any but dead weevil larvæ, but on the other hand, found many weevil larvæ dead or dying without any apparent cause. These observations indicate the existence of a similar condition to that found in this parasite of the wax moth. The killing of the host before ovipositing is a decided advantage to such an ectoparasite since it insures the safety of the eggs and larvæ from injury due to movements of the host within the cocoon.

Dibrachys chlisiocampæ and possibly others of the same group apparently form the connecting link between the scavangers and the parasites since the larvæ feed entirely on dead and decaying material killed by the parent.

Since the dead larvæ on which these parasites feed are in a state of decomposition and continually changing chemically and physically during the feeding period, it is possible that under the

* Packard, 1909, A Text Book of Entomology, page 358.

† Marcovitch, 1916, The Strawberry Weevil in Minnesota. Sixteenth Report of the State Entomologist of Minnesota for 1915 and 1916, page 122.

proper conditions, such parasites could be fed upon some animal material other than insect larvæ. This would make it possible to rear parasites on a scale large enough to be of practical importance in the control of some insect pests, inasmuch as one of the greatest difficulties in the raising of parasites, lies in the problem of providing a sufficient amount of suitable food.

SUMMARY.

1. *Dibrachys clisiocampæ* Fitch, is parasitic upon the larvæ and pupæ of the wax moth and should be a valuable parasite in controlling the wax moth in stored combs.

2. The length of life cycle is rather variable requiring from 31 to 59 days for completion.

3. The female parasite stings and kills the host before ovipositing.

4. It may be possible to rear these and other valuable ectoparasites on some food, other than their natural host.

EXPLANATION OF PLATE XIX.

FIG. 1. Eggs of *Dibrachys clisiocampæ* on a pupa of the wax moth.
FIG. 2. Larvæ and eggs of *Dibrachys clisiocampæ* Fitch upon larva of wax moth.
FIG. 3. Young larvæ of *Dibrachys clisiocampæ* Fitch on wax moth larva.
Fig. 4. Pupæ of *Dibrachys clisiocampæ* Fitch upon a wax moth larva.